



US006465902B1

(12) **United States Patent**
Beauchamp et al.

(10) Patent No.: **US 6,465,902 B1**
(45) Date of Patent: **Oct. 15, 2002**

(54) **CONTROLLABLE CAMBER WINDMILL
BLADES**

6,138,956 A * 10/2000 Monner 244/215
6,142,425 A * 11/2000 Armanios et al. 239/562
6,394,397 B1 * 5/2002 Ngo et al. 244/198

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* cited by examiner

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(57) **ABSTRACT**

The present invention relates to a windmill power generation system which includes at least two variable camber blades fastened to a rotatable hub, which blades are driven by a fluid such as wind. Each of the variable camber blades has embedded shape memory alloy members. The system also includes a source of electrical power connected to the shape memory alloy members for varying the shape of the blades in response to changes in the speed of the fluid driving the blades. The power generating system further includes a power regulator connected to the electrical power source for regulating the electrical power being supplied to the shape memory alloy members and a controller for transmitting a power command signal to the power regulator. The controller preferably comprises a preprogrammed computer having an algorithm for generating the optimum blade shape for a particular wind speed or condition.

(21) Appl. No.: 09/837,746

(22) Filed: Apr. 18, 2001

(51) Int. Cl.⁷ B64L 27/00

(52) U.S. Cl. 290/55; 290/1 R; 244/215;
416/155

(58) Field of Search 290/1 R, 44, 43,
290/54, 55; 244/215; 416/155

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,062,175 A * 11/1991 Buchanan et al. . 15/250.203
6,065,934 A * 5/2000 Jacot et al. 244/75 R

19 Claims, 3 Drawing Sheets

